REMARKS

Applicants appreciate the examination of the present application, which is evidenced by the Official Action of March 25, 2003, and the indication that Claims 41-45 and 49-50 are allowed. Applicants also appreciate the indication that Claims 4-20, 23-24, 26-29, 32, 34-36, 38 and 47 recite allowable subject matter.

In response, Applicants have rewritten Claims 4, 10, 26, 34, 38 in independent form and amended Claim 39 to depend from Claim 38. Accordingly, Applicants now submit that Claims 4-20, 26-28, 34-36 and 38-39 are in condition for allowance. Applicants have also amended page 12 of the application by deleting a reference to a patent number of a pending commonly-assigned application that has not yet been allowed.

Thus, the sole outstanding issues are the rejections of Claims 1-3, 21-22, 25, 30-31, 33, 37, 40, 46 and 48 under 35 USC § 103(a).

"Texture Detail" and "Object Detail" are Not the Same Thing

Applicants respectfully submit that the Examiner's repeated assertions in the Official Action that level-of-detail (LOD) texture is equivalent to object detail is erroneous. As described at Col. 1 of Migdal et al., graphical object detail includes points, lines, polygons that make up three dimensional objects. However, texture detail includes applying color and other surface detail to areas and surfaces of an object. As explained by Migdal et al., "[i]n texture mapping, a pattern image, also referred to as a "texture map," is combined with an area or surface of an object to produce a modified object with the added texture detail. For example, given the outline of a featureless cube and a texture map defining a wood grain pattern, texture mapping techniques can be used to "map" the wood grain pattern onto the cube. The resulting display is that of a cube that appears to be made of wood." (Migdal et al., Col. 1, lines 22-29). In other words, "object detail" relates to geometric and structural detail of an object and "texture detail" relates to the visual quality of an object surface.

Accordingly, when Migdal et al. describes level-of-detail (LOD) texture, it is describing how the resolution of texture may be varied depending on the viewpoint

of the observer. In particular, Migdal et al. describes how a texture pattern may be filtered at various resolution levels to generate various LOD maps. (Migdal et al., Col. 1, lines 49-51). However, these LOD maps represent texture maps, not different levels of detail relating to the corresponding 3-D object to which the texture is ultimately applied. Thus, it cannot be reasonably argued that a plurality of LOD texture maps, which address different levels of texture resolution based on the viewpoint of the observer, is equivalent to deriving a texture map from a high resolution object model (e.g., a fine digital representation of an object) and applying this texture map to a lower resolution object model (e.g., a coarse digital representation of the object) that can be rendered on a display with much less computational expense, as recited by many of the claims of the present application.

Claims 1, 25, 30, 33, 40 and 46 are Patentable over the Cited Prior Art

Applicants respectfully request reconsideration of the Examiner's outstanding rejections of independent Claims 1, 25, 30, 33, 40 and 46, which are based primarily on the disclosure of U.S. Patent No. 6,417,860 to Migdal et al. As Applicants will now show, Migdal et al. has little, if any, relevance to the subject matter of the pending claims. This is because Migdal et al. addresses how to render digital images on a display using relatively small "clip-map" texture data files that are derived from much larger texture MIP-maps. The use of relatively small clip-map texture data files is required because the use of large texture MIP-maps is unmanageable in existing rendering systems:

> "Under conventional texture mapping techniques, even if texture data were to be accessed from a remote, large texture MIP-map, the rendering of a textured image for display in real-time would be impractical, if not impossible. The [Migdal et al.] invention, however, realizes the advantages of accommodating large texture MIP-maps in one or more mass storage devices **208** without reducing texture access time. A relatively small clip-map representing only selected portions of a complete texture MIP-map is stored in a texture memory **226** having a fast rate of data return. In this way, texture

> memory **226** acts as a cache to provide texture rapidly to the raster subsystem **224**.
>
> This hierarchical texture mapping storage scheme allows huge texture MIP-maps to be stored rather inexpensively on the mass storage device **208**. Based on the viewer eye point and/or field of view, only selected portions of a texture MIP-map corresponding to the texture motif to be rendered for display need to be loaded into the texture memory **226**. In this manner, large 2-D or 3-D texture MIP-maps can be used to provide texture rather inexpensively, yet the textured images can be rendered in real-time." (Migdal et al., Col. 7, line to Col. 8, line 2).

Thus, Migdal et al. describes a rendering system whereby relatively small portions of a much larger texture MIP-map are used to support relatively high speed rendering of a digital image on a display. As the viewer's point of view or the field of view on the display changes, new "clip-maps" are acquired from a high speed texture memory, which operates as a cache memory. (Migdal et al., Col. 5, lines 22-40).

In stark contrast to Migdal et al., the invention recited in the above-identified independent claims is directed at generating a "light weight" digital model of a 3-D surface. This "light weight" digital model represents a "coarse" digital model that can be rendered at high speed because it is a relatively "inexpensive" model from a computational standpoint. The "coarse" digital model uses model-enhancing texture maps. In order to provide a high degree of realism to the coarse digital model, a texture map is obtained by "mapping points within the texture map to a fine digital representation of the 3-D surface." This fine digital representation of the 3-D surface, which is typically not rendered on the display, represents a much more expensive model from a computational standpoint. Nonetheless, by using the fine digital representation to generate the texture map and then applying this texture map to the coarse digital representation, a much higher degree of realism can be achieved even when rendering a computationally inexpensive model (i.e., the coarse digital model).

Based on these distinctions, Applicants submit that Migdal et al. provides absolutely no disclosure or suggestion of generating two models at different levels of resolution (i.e., a coarse model and a fine model) and then enhancing the rendering of the "cheap" coarse model using a texture map derived from the "expensive" fine model. Accordingly, independent Claims 1, 25, 30, 33, 40 and 46 are patentable over the cited prior art.

Claims 37 and 48 are Patentable over the Cited Prior Art

The arguments provided above with respect to Claims 1, 25, 30, 33, 40 and 46 are hereby incorporated herein by reference. In Claims 37 and 48, the texture map is recited as containing "information derived from mapping spatial points on the triangulation model to object points on another model derived from the colored scan data." Again, Migdal et al. provides absolutely no disclosure or suggestion of generating a texture map containing information derived from mapping points on one model (e.g., coarse model) to points on another model (e.g., fine model). Instead, Migdal et al. discloses generating a texture map (i.e., a texture MIP-map) as "source data representing a particular texture motif at its highest resolution" and then rendering an object on a display using a texture "clip-map" that is taken from only portions of the texture MIP-map. (Migdal et al., Col. 5, lines 48-57). Using portions of a much larger texture map to provide a limited rendering of an object on a display does not constitute a disclosure or suggestion of generating two distinct models at different levels of resolution and then enhancing the rendering of one model using a texture map derived from another model. Accordingly, Applicants respectfully submit that independent Claims 37 and 48 are patentable over the cited prior art references.

Dependent Claim 21 is Independently Patentable

Dependent Claim 21 is patentable for at least the reasons that independent Claim 1 is patentable. Moreover, dependent Claim 21 recites determining a texture map for a coarse digital representation of a surface by determining a texel coordinate in a first texel in a texture map. This texel coordinate identifies a first spatial point on a coarse digital representation of the surface. To create the texture map, this first spatial point is projected to a first object point on the fine digital representation of the surface. Thus, not only does Claim 21 recite separate coarse and fine digital representations of the surface, but also includes operations to determine texel coordinates by projecting between coarse and fine digital representations of a surface. Migdal et al. provides absolutely no disclosure or suggestion of this additional aspect of the invention recited by dependent Claim 21.

CONCLUSION

Applicants have shown that Claims 4-20, 26-28, 34-36 and 38-39 are now in condition for allowance along with previously allowed Claims 41-45 and 49-50. Applicants have also shown that independent Claims 1, 25, 30, 33, 37, 40, 46 and 48 are patentable over the cited prior art references along with corresponding dependent claims. Accordingly, Applicants submit that the present application is in condition for allowance, which is respectfully requested.

Respectfully submitted,

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